NIST Tasks under the 2007 Energy Independence and Security Act (EISA)

The mission of the National Institute of Standards and Technology (NIST) is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve the quality of life. A non-regulatory agency, NIST works closely with the private sector in promoting the use of standards. One of NIST's key responsibilities is to support objectives of federal participation in the development and use of voluntary standards. While it does not act as an official standards development organization (SDO) for the U.S., NIST personnel account for over 1000 memberships in accredited standards organizations and also participates in numerous consortia and industry groups. NIST plays a major role in initiating, coordinating, researching, and developing standards, and subsequently encouraging the progress of these efforts within other standards-development fora and the adoption and use of these voluntary standards by industry and government.

With the enactment of the 2007 Energy Independence and Energy Security Act (EISA), NIST has the primary responsibility for coordinating the development of a framework to achieve interoperability of Smart Grid devices and systems that includes protocols and model standards for information management. Interoperability is a key challenge to achieving the vision of the Smart Grid. Without it, it will not be possible to add new alternative and renewable energy sources to the grid or to enable customer participation. NIST will coordinate this framework with input from many key stakeholders in the development of the Smart Grid: federal and state government agencies, regulatory groups, electric utility organizations, and electric power equipment manufacturers. NIST will publish an initial report on progress toward recommended or consensus standards and protocols within one year of enactment of EISA (December 19, 2007) , Additional reports will be produced as significant progress is made, and NIST will make recommendations on standards for adoption by the Federal Electric Regulatory Commission (FERC). Once FERC decides that there is sufficient industry consensus on standards, EISA calls for that agency to begin the rulemaking process to adopt those standards.

NIST also has representatives on the Department of Energy (DoE)-led Smart Grid Task Force, an interagency working group created to ensure awareness, coordination and integration of the diverse activities of the DoE Office of Electricity Delivery and Energy Reliability and other federal organizations related to Smart Grid technologies, practices, and services. These include, but are not limited to:

- Smart grid research and development
- Development of widely-accepted smart-grid standards and protocols
- Relationship of smart-grid technologies and practices to electric utility regulation
- Relationship of smart-grid technologies and practices to infrastructure development, reliability, and security, and the
- Relationship of smart-grid technologies and practices to other facets of electricity supply, demand, transmission, distribution, and policy

The Task Force will also collaborate with DOE's Electricity Advisory Committee and other relevant Federal agencies and programs. Dr. William Anderson, Director of the

NIST Electrical and Electronics Engineering Laboratory (EEEL), is the lead NIST representative. Dr. Gerald FitzPatrick of EEEL is also a member of the Task Force.

What is the "Smart Grid"?

The "Smart Grid" is a vision of modernization of the electric power grid for improved reliability, efficiency, safety, and the access of renewable and alternative energy sources. It involves the integration of modern communication and information technology into the electricity infrastructure. Much of the existing infrastructure is 30-40 years old. EISA (http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ140.110.pdf) has defined the smart grid as a "reliable and secure electricity infrastructure that can meet future demand growth" and achieve each of the following characteristics of the Smart Grid:

(1) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid.
(2) Dynamic optimization of grid operations and resources, with full cybersecurity.
(3) Deployment and integration of distributed resources and generation, including renewable resources.
(4) Development and incorporation of demand response, demand-side resources, and energy-efficiency resources.
(5) Deployment of 'smart' technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation.
(6) Integration of 'smart' appliances and consumer devices.
(7) Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
(8) Provision to consumers of timely information and control options.
(9) Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
(10) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

The above working definition of Smart Grid will be used in developing the NIST effort to support the establishment of Smart Grid protocols and standards.

Approach to fulfilling NIST requirements

As specified in the EISA, the focus of NIST research efforts in 2008 will culminate in a report to Congress in December that focuses the Nation on the progress toward recommended or consensus standards and protocols for the Smart Grid and begins to document a consensus vision of a path forward toward a completely interoperable future Smart Grid.

NIST began its efforts immediately after the passage of EISA, and has been focusing on collecting and organizing the current landscape of standards and interfaces between domains of the Smart Grid. The goal is to provide an up-to-date view of where the nation is with standards and among those standards and systems. This will become a platform for developing consensus on where interoperability gaps exist and priorities for addressing those gaps. By December of 2008 NIST will have a consensus statement on the state of interoperability and a draft roadmap for moving forward in addressing interoperability gaps. To support development of the report, ensure public awareness of the framework development, and to solicit input from stakeholders, NIST will create a website for posting a standards landscape, draft framework, and other developments. A presentation will be made at GridWeek (http://www.gridweek.com/2008/default.asp), a major Smart Grid conference, in September 2008 and a NIST Interoperability Standards Workshop will be co-joined with the GridInterop meeting in November. These efforts are detailed in the Work Plan that follows.

Work Plan

(1) Regular communications with the Smart Grid Interoperability Framework Stakeholders Group. This group includes: U.S. Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability (OE), Federal Energy Regulatory Commission (FERC), Gridwise Architectural Council (GWAC), North American Electric Reliability Corporation (NERC), Institute of Electrical and Electronics Engineers (IEEE), Electric Power Research Institute (EPRI), National Electrical Manufacturers Association (NEMA). Others will be included.

(2) Develop technical Domain Expert Working Groups (DEWGs)[1]. The intent of these groups is to provide input to the technical direction of interoperability issues, and leading work within standards groups on implementing needed standards development and harmonization. NIST has initially focused on the following domain groups:

i. Building-to-Grid (B2G)
ii. Industrial-to-Grid (I2G)
iii. Home-to-Grid (H2G)
iv. Transmission and Distribution (T&D)

[1] The Domain Expert Working Groups were set up at a kickoff meeting at NIST. See [PUT LINK HERE] for presentations from that meeting and links to the individual working group webpages.

I2G includes central generation plants. T&D includes distributed energy resource (DER) interconnections. Cross-cutting issues include security, time synchronization, and quality of service. Champions will be identified for each group along with a NIST representative. Group members will include key industry stakeholders including technical experts involved in the standards work that will carry forward standards development and harmonization efforts. A kickoff meeting for the DEWGs was held at NIST on August 5, 2008. Presentations discussing the DEWGs, their purpose, and other related GWAC and EPRI efforts are found at: http://www.nist.gov/smartgrid/presentations.html

(3) Work with GWAC, domain experts, and other partners on a high-level **Standards Landscape Map** that provides an overview of smart grid domains, interfaces, standards and participants, as well as progress toward interoperability. This Landscape Map is intended to provide a rich interface to a standards knowledge base as well as a starting point for developing a standards interoperability roadmap. The Landscape Map provides a place to indicate where interoperability exists already within a domain or where standards development and harmonization efforts are needed or in progress and the priority of those efforts.

(4) Develop a NIST Smart Grid Standards Knowledge Base (**NIST Smart Grid KB**), building on the efforts of existing stakeholder efforts (e.g., EPRI Intelligrid and the GridWise Knowledge Base), and updating new standards work of the last few years since they were developed. This KB will be made available online in an easily accessible format and linked to the Standards Landscape Map. An initial version of the KB will be online by the end of August 2008. The goal is to fill in the details behind the Standards Landscape Map. For each standard (existing or under development) the KB provides:

i. When initiated
ii. Where developed (by which groups)
iii. Domain and scope
iv. Security measures
v. Open System Interconnection (OSI) levels covered
vi. strengths and weaknesses
vii. overlapping/competing standards
viii. harmonization efforts underway
ix. additional harmonization required
x. estimated importance in domain

(5) Develop a draft **Smart Grid Standards Interoperability Roadmap** prior to Grid Interop. This should be done in cooperation with domain expert groups and with the Smart Grid Interoperability Framework Stakeholders Group, leveraging their vision, knowledge, tools, and time. Principles for guiding the roadmap development include:

i. Make use of existing knowledge, relying on domain experts to identify and do the work.

ii. Focus on application level (data content and representation) interoperability, NOT network and physical layers.
iii. Address system management and security policy
iv. Work from a common dictionary
v. Focus roadmap priority on high-impact areas where minimal coordination and direction can lead to large gains.
vi. Work on addressing standards that touch on multiple domains and by their acceptance will impact interoperability across the smart grid. An example might be the data representation for communicating pricing information among smart grid domains.
vii. Use accepted open-source tools for modeling and roadmapping
viii. Publish results online with high-quality interface that promotes interaction with stakeholder community and provides means for gathering feedback.

(6) Work with GWAC on planning a NIST Smart Grid Standards Workshop, Nov. 11-13, as part of the Grid Interop meeting in Atlanta. Grid Interop will be used for a number of purposes relative to NIST's EISA response:
i. Present a draft Smart Grid Standards Roadmap for moving towards Smart Grid standards interoperability
ii. In workshop breakout format, with domain expert group leaders, consider the roadmap in each domain and at important interfaces in order to refine the roadmap.
iii. Identify action items in each domain for moving things forward on technical, business and political levels. Prioritize actions. Identify people willing to take on each action item.
iv. Bring input together in a post-meeting Smart Grid Standards Roadmap 1.0 to be put online for further discussion and refinement.

(7) All our efforts and the Grid Interop results then become the content of the **December progress report** . The report will include:
i. Introduction with EISA directions and scope
ii. Summary of completed work efforts
iii. Standards Landscape Map and overview of Smart Grid KB.
iv. Draft Smart Grid Standards Roadmap
v. Summary of stakeholder input
vi. Future year plans

(8) Ongoing coordination of roadmap. NIST efforts in future years will include:
i. Identification of research efforts as needed to address gaps in smart grid standards
ii. Identification of standards interoperability harmonization efforts where NIST can serve most effectively as a catalyst to accelerate progress on roadmap.